

REMARKS

Applicants have amended claim 19. Claims 19-26, 31, 32, and 34-36, of which claim 19 is independent in form, are presented for examination.

As amended, claim 19 recites an electrochemical cell including an electrolyte that contains a lithium perchlorate salt and a lithium salt selected from the group consisting of lithium trifluoromethanesulfonate, lithium trifluoromethanesulfonimide, and lithium hexafluorophosphate. The molarity of lithium ions in the electrolyte is equal to the sum of the molarity of perchlorate ions in the electrolyte and the molarity of trifluoromethanesulfonate ions, trifluoromethanesulfonimide ions, or hexafluorophosphate ions in the electrolyte.

Support for the amendment to claim 19 can be found, for example, on page five of the application, which states that,

The electrolyte . . . contains a lithium salt such as lithium trifluoromethanesulfonate (LiTFS) or lithium trifluoromethanesulfonimide (LiTFSI), or a combination thereof. . . . In some embodiments, the electrolyte may contain LiPF_6 The electrolyte also contains a perchlorate salt, which inhibits corrosion in the cell. Examples of suitable salts include lithium . . . perchlorate[.]. (Application, page 5.)

Each of the salts provided in the above paragraph includes one lithium cation for every one trifluoromethanesulfonate, trifluoromethanesulfonimide, hexafluorophosphate, or perchlorate anion. Thus if, for example, a lithium trifluoromethanesulfonate salt and a lithium perchlorate salt are added into a battery electrolyte, there will be a corresponding lithium cation for each trifluoromethanesulfonate anion in the electrolyte, and a corresponding lithium cation for each perchlorate anion in the electrolyte, and the molarity of lithium ions in the electrolyte will be equal to the sum of the molarity of perchlorate ions in the electrolyte and the molarity of trifluoromethanesulfonate ions in the electrolyte.

Additional support for the amendment to claim 19 can be found, for example, in Example 1 of the application. (See Application, pages 6-8.) Several of the electrochemical cells in Example 1 were prepared by adding a lithium perchlorate salt to an electrolyte that included a lithium trifluoromethanesulfonate salt. After the addition of both the lithium

trifluoromethanesulfonate salt and the lithium perchlorate salt into the electrolyte, the molarity of lithium ions in the electrolyte was equal to the sum of the molarity of perchlorate ions in the electrolyte and the molarity of trifluoromethanesulfonate ions in the electrolyte.

The Examiner may claim, as he has in the past, that U.S. Patent No. 6,165,644 ("Nimon") renders claims 19-26, 31, 32, and 34-36 unpatentable under 35 U.S.C. § 103(a). But Nimon does not disclose or suggest the electrochemical cell recited in claims 19-26, 31, 32, and 34-36.

Nimon discloses lithium-sulfur batteries with sulfur cathodes. (See, e.g., Nimon, col. 9, line 6 — col. 12, line 2.) Nimon explains that the batteries can include an optional electrolyte salt:

Exemplary but optional electrolyte salts for the battery cells incorporating the electrolyte solvents of this invention include, for example, lithium trifluoromethanesulfonimide ($\text{LiN}(\text{CF}_3\text{SO}_2)_2$), lithium triflate (LiCF_3SO_3), lithium perchlorate (LiClO_4), LiPF_6 , LiBF_4 , and LiAsF_6 (Id., col. 10, lines 13-17.)

The addition of one of the salts in the above list to Nimon's batteries is optional because, as Nimon explains, the sulfur electrode in his batteries already forms electrolyte salts during use:

As indicated above, the electrolyte salt is optional for the battery cells of this invention, in that upon discharge of the battery, the metal sulfides or polysulfides formed can act as electrolyte salts, for example, $\text{M}_{x/z}\text{S}$, wherein $x=0$ to 2 and z is the valence of the metal. (Id., col. 10, lines 20-24.)

Given that Nimon states that the addition of an electrolyte salt from the above list is optional, a person of ordinary skill in the art, upon reading Nimon, certainly would not have been motivated to include multiple lithium salts from Nimon's list of optional salts in a battery electrolyte.

The Examiner has asserted that,

Nimon et al. teach an electrolyte for use in a lithium battery wherein the electrolyte comprises two lithium salts, i.e., lithium polysulfide (Li_2S_8) and lithium trifluoromethanesulfonimide (LiTFSI). In another embodiment, Nimon et al. disclose the use of lithium polysulfide and lithium triflate (LiCF_3SO_3) as the electrolyte. . . . It is evident that the teachings of Nimon describe the use of multiple lithium salts as the electrolyte in the battery. (September 9, 2004 Examiner's Answer, page 6.)

While Nimon may disclose the use of two lithium salts in a battery electrolyte, Nimon does not disclose or suggest using multiple salts selected from his optional electrolyte salt list in a battery

electrolyte. The lithium polysulfide salt in the above examples is not one of Nimon's listed optional salts. In an "Overview" of his application, Nimon notes that:

[I]n a general aspect, the present invention provides an electrochemical cell having a lithium metal electrode having a surface coating that is effective to increase the cycling efficiency of the electrochemical cell. In a more particular aspect, the electrochemical cell includes an electrolyte solution, and, still more particularly, a polysulfide-containing electrolyte solution. Several embodiments of the invention are presented below. (Nimon, col. 4, lines 6-13.)

Later, Nimon provides his list of optional electrolyte salts, separately from his disclosure of a polysulfide-containing electrolyte. Nimon's list of optional electrolyte salts does not include lithium polysulfide, since Nimon previously described polysulfides as an electrolyte component of one of the embodiments of his battery. Thus, Nimon's disclosure of batteries that include lithium polysulfide and lithium trifluoromethanesulfonimide or lithium triflate is not a disclosure or suggestion to use more than one of his optional electrolyte salts in a battery.

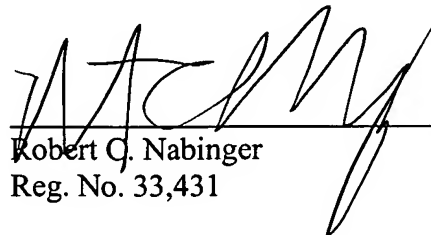
Applicants believe that claims 19-26, 31, 32, and 34-36 are in condition for allowance, which action is requested.

No fee is believed to be due. However, please apply any charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: _____

11/23/01


Robert C. Nabinger
Reg. No. 33,431

Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110-2804
Telephone: (617) 542-5070
Facsimile: (617) 542-8906